CURI[illegible]S

OBSERV[illegible]TIONS

In tha[illegible]fficult part of

CHIRURGERY,

Relating to the

TEETH.

SHEWING,

How to Preserve the Teeth and Gums from all Accidents they are subject to.

By Chas Allen (81)

AS,

1. An Account of their Nature. 2. Their Alteration, with their proper Remedies. 3. Their Cauſe of Corruption and Putrefaction. 4. Directions for reſtoring or ſupplying the defect of them in old or young. 5. Conſiderations on the Tooth-Ache, Looſeneſs of the Teeth, the decay of the Gums, with their Remedies and Reſtoratives. 6. The uſe of the POLICAN or Inſtrument wherewith, they are drawn on all Occaſions. Laſtly, Teeth in Children, what they are in the Original, and how they come to Perfection, in what order produced, the means to haſten them, and render them eaſie in breeding.

To which is added,

A Phyſical Diſcourſe, wherein the Reaſons of the beating of the Pulſe, or Pulſation of the Arteries, together with thoſe of the Circulation of the Blood are explained, and the Opinions of ſeveral Ancient and Modern Phyſicians and Philoſophers, as *Gallen*, *Gaſſendus*, *Carteſius*, *Lower*, *Willis*, &c. Upon this Subject are examined.

DUBLYN: Printed and are to be ſold in *London*, by *William Whitwood* in *Duck-Lane*, 1687.

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OBSERVATIONS

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CHIRURGERY,

Relating to the

TEETH.

SHEWING,

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1. An Account of their Nature. 2. Their Alteration, with their proper Remedies. 3. Their Cause of Corruption and Putrefaction. 4. Directions for restoring or supplying the defect of them in old or young. 5. Considerations on the Tooth Ache, Looseness of the Teeth, the decay of the Gums, with their Remedies and Restoratives. 6. The use of the POLICAN or Instrument wherewith, they are drawn on all Occasions. Lastly, Teeth in Children, what they are in the Original, and how they come to Perfection, in what order produced, the means to hasten them, and render them easie in breeding.

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To which is added.

A Physical Discourse, wherein the Reasons of the beating of the Pulse, or Pulsation of the Arteries, together with those of the Circulation of the Blood are explained, and the Opinions of several Ancient and Modern Physicians and Phylosophers, as *Galen*, *Gayfardus*, *Cartesius*, *Lower*, *Willis*, &c. Upon this subject are examined.

DUBLIN, Printed and are to be sold in *London*, by *William Whitwood* in *Duck-Lane*, 1687.

TO THE

MOST HONOURABLE AND TRULY LEARNED

The Physitians, Chirurgions and Apothecaries Of the City of DUBLIN.

GENTLEMEN,

WHen I see your INDEFATIGABLE Care in procuring men (that without which all the World is nothing) HEALTH, the PRIMARY cause, sole Foundation and Prop of Humane FELICITY; and how the experience of so many years manifests to all men, by the happy success of your Undertakings, and your great Charity to the Poor, that your private intentions do correspond admirably well with your external actions; and that all your indeavours are real and unfeigned: I am perswaded, that whatever can in any wise contribute to the promoting of your most Noble and Generous Design, can't but be acceptable to you. Wherefore having with the same pasion, for the pub-

lick Advantage, composed the following small Treatise, I take the liberty most humbly to present it You; that (as You are the best JUDGES of the thing) so You may by Your Judicious and Impartial Censure of it, inform the World of its worth; that no person may be deceiv'd in it. For my intentions in publishing it, being to advance the common Good; if I thought it did contain any thing contrary to that DESIGN, I shou'd be the first that wou'd indeavour its suppression.

But, GENTLEMEN, besides the foregoing reasons, which I had of offering You this first Essay of mine, I did it also to acquit my self in some measure of my Duty towards You; and to assure You further, that I am in all respects,

GENTLEMEN,

Your Most Humble, Most Obedient, And Most Obliged Servant

CHARLES ALLEN.

OPERATOR FOR THE TEETH.

The PROEM.

KNowing that it is the duty of every man, and especially of such as live under a Civil Government, (where the general Interest always includes the particular) to contribute as much as he can (in his own station) to the publick Good: and also of what Importance it is to all men to be informed of those Benefits which by my Art they may enjoy; I am resolved to set down here what I think most convenient for every one to understand concerning the preservation, and melioration of his own Teeth; A thing indeed of little esteem among most people, but in truth, of inestimable value for its many and important consequences. However, in so doing, I shall acquit my self of my duty towards God and Man. And provided my Indeavors prove but beneficial to others, (as certainly they will, if put in practice) it is all I desire, caring very little what opinion the Criticks of Words and artificial Logick may have of me.

Of what Utility this Undertaking of mine may be to every body, will appear by the sequel of this Discourse; whereof the scope

Scope is to prevent the loss of Teeth; the use of which is so necessary in the preparing of food, that the want of such a help (if not supplied by strong dissolvents) hinders a true concoction of the Aliments in the Stomach; whence do proceed Indigestions, and abundance of Crudities very noxious to the body of man; as being the seed of most of those innumerable Diseases and Infirmities, whereby life is not only made troublesome to us, but also considerably shorter than it would otherwise be, which is so consonant to truth, that vulgar observation it self has turned it into a common Proverb: For they use to say of one whose Teeth are naturally thin, that he is short-liv'd, whereof the reason is, that such persons do not chew their meat well. Moreover, the loss of Teeth renders the pronunciation both troublesome to ones self, and unintelligible to others. In a word, the corruption, and want of them, is as great a deformity, and of as much prejudice to one, as any thing whatsoever can be.

SECTION I.

Of the Nature of the TEETH.

WHat men are wont to call Science, or the Cognition of any thing, is by them commonly divided into two several parts: one whereof is termed *Theoretical*, and the other *Practical*. The first includes the reasons and causes of things, with the order and manner of their progress in coming to be what they are. The second regards only their Properties and Effects, and what they are actually in themselves, without inquiring how they come to be so made or thus qualify'd. As for example of those two branches of Humane Learning, (in respect to Physical matters) when Philosophers go about to inspect the nature of the *Loadstone*, they search into its *Origine*, tracing out the several causes of its Formation, even to their source or spring-head; from whence they draw arguments for the solution of all the *Phænomena* thereof: whereas Mariners consider it only as a certain stone that draws Iron to it self, having the power of communicating its properties to the said Iron; and which, if not hindred (by its own gravity, or any other impediment) will always turn one of its sides towards the North, and another diametrically opposite to the first towards the South; which sufficeth them for the use they make on't, in directing their courses through the Sea, without caring what may be the cause of so admirable

mirable vertues in the *Magnet*. Either of which constituent parts of Knowledge being ſeparated from the other, cannot afford a full and ſatisfactory account of a thing: And therefore being about to treat of my Art, I ſhould by conſequence begin with its *Theory*, and diſcourſe of the *Elements*, *Principles*, and firſt *Rudiments* of the *Teeth*, which make the Subject thereof, unfolding the reaſons of their conſtitution and frame, and how they come to have ſeveral Roots, and to grow above the Gums; with what ever elſe may be the cauſe of their ſpecifical being; and thence paſs to the Practice. But ſome Conſiderations obliging me to defer treating of the former *Part*, or *Theorick*, till a better opportunity, I deſign only to lay down in this Paper ſome of the moſt principal *Points* relating to the other, namely, the Practical part of my *Profeſſion*. In doing which, although it would be enough for us to ſpeak of things, as in the ſtate wherein we find them: yet for the ſatisfaction of the Reader, and out of a real deſire to ſerve him; we ſhall not deſtitute our Diſcourſe of ſuch Reaſons as are neceſſary for the well underſtanding of what we ſhall ſay. So that although this Tractate will be imperfect, as wanting many things, yet what it ſhall contain, will be as uſeful and advantageous as if it were accompanied with all the reſt. However, according to the method we have preſcribed our ſelves here, we are to proceed next to the conſideration of the Structure, and conſtitution or nature of the Tooth.

In *Analyſing* the Tooth, its ſubſtance is not found to

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be uniform every where, but manifeſtly diſtinguiſhable into two different ſorts of make: one of them being harder, whiter, and of a finer texture; and the other ſofter, more obſcure, and of a courſer compoſition. The firſt makes up the head of the Tooth, or that part of it that ſtands out naked above the Gums; and the other its ſtump, or that part on't which is hidden within the ſaid Gums. The expoſed part of the Tooth conſiſts alſo of two different Parts: To wit, its ſtony Cover or Caſe, and its inward ſubſtance; the firſt is as it were an hard *Periosteum*, that inveſts the head of the Tooth on all ſides, lying on it much after the ſame manner that Enamel does upon Gold, or any other thing. This natural Enamel which I call the gloſs of the Tooth, is of a far harder, whiter, more denſe and lucid nature than the inward ſubſtance lying under it: which for its ſeveral uſes may properly be compared to the *Cuticula*, or Scarf-skin, for like unto this it is bloodleſs, and altogether deſtitute of ſenſe, ſerving to cover and defend the extremities of the Veſſels, contained within the inward ſubſtance, from external injuries, and to render the Tooth more beautiful and ſtrong. It has pores for the perſpiration of the excrements of the Tooth, which pores are not always of the ſame figure, nor magnitude, but vary almoſt in every body. The ſaid gloſs or ſtony ſubſtance is likewiſe very various in point of thickneſs: from which differences, do ariſe the diverſity of its colour in ſeveral men.

The inward part of the head of the Tooth, though

inferior to its cover or gloſs in brightneſs and ſolidity, yet its ſubſtance is nevertheleſs much more compact, and clearer than that of the ſtump; and contains two ſeveral ſorts of pores, or ſmall channels, both of a conical figure, having their *Baſes* in the *concave ſuperficies* of the Tooth, and their *Apexes* in the *convex ſuperficies* of the inward ſubſtance, immediately under its glaſſy integument. Through ſome of which channels the blood is carried by many and very ſmall *Arterial* Sprigs, from the middle of the Tooth to its extremity; and through the others the ſame blood is ſent back again from the ſaid extremity towards its middle, by ſome *capillary* veins, as ſhall be ſaid hereafter.

As to the root or ſtump of the Tooth, it is the darkeſt, moſt ſoft, and porous portion of its whole ſubſtance; and yet is cloſer and harder than any other bone of the body, having alſo two ſorts of channels, but of different ſituation from one another; for ſome of them have their Baſes (like thoſe above deſcribed) towards the cavity of the Tooth, and contain the branches of the Artery, that carry the blood quite through the ſubſtance of the Tooth, to the Gums, as ſhall be explained in its place; but the others contrary to any of thoſe already mentioned, have their Baſes towards the external ſuperficies of the Tooth; the uſe of which laſt conduits, is to tranſmit to the Gums the blood that is returned to the heart from the *membrane* that inveſts the cavity of the Tooth. This rooty part of the Tooth conſiſts in the ſmall Teeth

of

of a ſingle body, and in the big ones is divided into two, three, or four branches, called roots or fangs: along the middle of each of theſe fangs, there is a little channel that goes up to the head of the Tooth, where they are united together, and make but a ſingle cavity, whereinto are carried the veſſels of the Tooth, paſſing firſt through the hollowneſs of the ſtumps. Every Tooth has its particular cell or ſocket within the *Mandible*, diſtinct from all the reſt (by a thin production of the jaw-bone paſſing between the Teeth, from one ſide of the ſaid bone to the other) wherein moſt of its ſtump is comprehended, the reſt being incompaſſed about with the Gums.

SECT. II.

Of the Alteration of the Teeth, *with their* Remedies.

FRom the conſideration of the nature of the Teeth, let us now paſs to that of the firſt ſtep of their degenerating, or mutation. For the better underſtanding of which, we ſhall take notice, that as our body is ſo made by nature, that it waſts continually by the diſſipation of ſome Particles, ſeparating themſelves from its Maſs, without intermiſſion; (tranſpiring for the moſt part through the pores of the skin) and that if theſe particles (which being divided from the whole, become *Excrementitious*) are kept too long within the body, (by reaſon of the *Opilation* of the ſaid pores) it cauſes Fevors, and great diſorders in our blood, and vital as well as animal Functions: So likewiſe from

the ſubſtance of the Teeth are emitted certain *Effluviums* through their pores, the tranſpiration of which being hindred, (by the obſtruction of thoſe inviſible paſſages) the Teeth become liable to all thoſe infirmities hereafter to be mentioned.

The ſubſtance of the Tooth being rigid and inflexible, it cannot be *Opilated* by contraction, or aſtriction: as the skin uſually is but only by the intruſion of ſome extraneous matter into its pores, or the incruſtation of ſome ſlimy ſtuff upon its ſuperficies; which is done when we eat any thing of a glutinous nature, for then ſome of its moſt viſcous parts do ſtick, and cleave about the *Teeth*; and by the mixture of ſome tartarious particles coming from the Lungs, the heat of the mouth, and a certain petrifick juice diſtilling into the mouth, out of the *Salival Ducts*, is turned into a ſtone-like ſubſtance, commonly called the ſcales or ſcurf of the *Teeth*: theſe ſcales grow thicker and thicker continually, and if let alone, will cover the *Teeth* all over, except juſt at the top where they grind one againſt another.

Having thus taken notice of the production of thoſe ſcales, let us now conſider of what ill conſequences they may be to the *Teeth*. The firſt whereof is the *Opilation* of their pores, from whence proceed all the reſt: for by that the exit of thoſe *Excrementitious* particles before mentioned being hindred, it cauſes them to ſtagnate within the body of the *Tooth*, and there corrupting, do corrode it by degrees; beginning firſt by the alteration of its colour from white to yellow,

and

and from yellow to black; and then follows the real decay of its ſubſtance, *&c.*

The ſaid humor is not only deſtructive to the *Teeth*, but extends alſo its maligniity to the Gums; ſome of its particles being ſubtil enough (after a due *fermentation*) to paſs through the ſcales, and thence ſliding between the Gums and the *Teeth*, they eat clear away the ligaments that tye them together, dividing them one from another to the very jaw-bone: which is ſufficiently proved by the *excoriation* and rawneſs of the Gums, and their being ſo tender and looſe from the *Teeth* where ever ſuch ſcales are found; and eſpecially if they be grown to a conſiderable thickneſs.

It happens ſometimes that the uſual paſſages of this corrupted humor being ſtopt by the ſcales, (when they are hard, and cloſe enough) is thereby repercuſſed, and made to take its courſe towards the middle of the *Tooth*, diſcharging it ſelf therein between the *Concave ſuperficies* of the *Tooth*, and the *Tunicle* inveſting the ſame; where it occaſions very great pains, and at laſt by its fretting, and corroſive quality, gnaws and conſumes quite away the ſaid *membrane*, as alſo the veſſels of the *Tooth*; and then paſſing out of the ſaid *Tooth*, it diffuſes it ſelf through the *Alveolus* or ſocket, where exerting its dangerous faculty, it deſtroys utterly whatever cauſes any *connexion* between the *Teeth*, the jaw-bone and the Gums, as the *Periofteum*, &c. After which the *Teeth* do conſequenrly fall out for the moſt part ſound, and unaltered, except only in their colour, (which becomes yellowiſh) by reaſon that the

aforeſaid

aforesaid *Excrementitious* Humour being at first diverted another way, did not stay long enough under the scales to occasion in them a greater detriment: All which incommodities to obviate, keep only your Teeth clean from scurf, or any foulness; and if they be already clean, you need but to preserve them as they are; but if not, get them to be made so by some Artist in that Function; for otherwise if you employ any body that is unskilful in it, you may chance to find the Remedy worse than the Disease; by reason that not knowing the dangers attending such an Operation, he may commit a great many and pernicious Errors, as the breaking of the *Film* that unites the Gums to the Teeth, the taking away of the gloss of the Teeth, *&c.* Soon after which, the Tooth will lose its natural lustre, and become yellowish, subject to ake, and at last wholly perish away, the Gums being loose and broken, will likewise decay, and fall away from the Teeth, *&c.*

Your Teeth being once clean, you may preserve them with this composition; Take *Magistery of Pearls*, *Powder of Coral*, and *Dragons-Blood*, of each equal quantity, and as much *Red-Rose-water* as will incorporate them together; and make the Compound of a mean consistence, between hard and soft. I have to that effect a very excellent *Dentifrice*, which being used only once a week will keep the *Teeth* clean and white; and by the constant using of it, fetch up their colour, if lost; (tho in a considerable measure) this is the same that in my *Bills* (to keep my Masters term, tho improper,

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as he well knows himſelf,) I call an *Opiat*.

SECT. III.

Of the Corruption of the Teeth, *with their Remedies: Whereto is Annexed the Deſcription and Uſe of the* Pelican.

HAving in the former Section conſidered the *Teeth*, as at the beginning of their decay, in ſuch a condition as tho they ſuffer ſome light change in their accidents, yet their ſubſtance, form and proportion remaining ſtill the ſame, is only called alteration; that is, in a ſtate wherein indeed they are inviroued, and aſſaulted by their greateſt enemies, but yet in a capacity of being reſcued and preſerved from their harms. But now we ſhall conſider them as overcome by all thoſe threatning evils, and really corrupted; in which caſe, all that can be done, is to prevent their total ruine.

And as there are ſome not ſo far gone, but that they may ſtill do good ſervice, if timely helped, we are to uſe our utmoſt indeavours to do it; which to effect, we ſhall, in the firſt place clear their outſide from all foulneſs and then with a proper Inſtrument ſcrape off whatever is rotten within, waſhing them very well afterwards with ſome convenient liquid, to ſcour and ſmooth away what the Inſtrument may leave behind: and then if the Tooth be ſo hollow that it may be ſtopt, it muſt be fill'd up with ſuch ingredients as are neither corroſive, nor ill taſted, and of a conſiſtence firm enough to be uſed in the ſame manner

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ner as the *Teeth* are, and to keep from waſting for a conſiderable time; but if the *Tooth* rots every way equally, ſo that there is no cavity left, wherein any thing can keep faſt, it muſt only be kept clean, taking care after every meal to pick out any meat that may get into it, and then waſh it very well with fair water; for if you neglect ſo to do, the corruption of the rotten *Tooth* will fall upon the others, and ſo infect all the reſt.

With theſe precautions, I would adviſe every one to keep his *Teeth* as long as he can, although they were rotten to the very Gums, provided only they do not ake, by reaſon that their ſtumps filling up their ſockets, ſerve (like ſo many wedges) to keep the others ſtreight and firm in their places; but if they are very bad, and withal ſubject to ake, it is better to have them out, leſt they ſhould occaſion an ill habit in the Gums, that might be hurtful to the ſound ones.

The Drawing out of *Teeth* is practiſed by a great many, but perhaps underſtood but of very few; and I am ſure that there is a great deal more danger in the Drawing of a *Tooth*, eſpecially out of the lower Jaw, than moſt people are commonly aware of. It is an Operation that requires to be performed with great care and circumſpection, and not ſo rafhly as it is commonly done.

But as the greateſt difficulty of this Buſineſs lies in underſtanding the make, and application of the Inſtruments that are imploy'd about the Drawing of *Teeth*; I ſhall (for the benefit of *Practitioners*, as well

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as of thoſe that will be their *Patients*) ſubjoyn here, the deſcription and uſe of the *Polican*; which is one of the beſt of them.

The Deſcription and Uſe of the Polican.

THe Conſtruction, and uſual ſhape of the *Polican*, is a thing ſo well known by every body, that it wou'd be needleſs to inſiſt at all upon it. And therefore, without loſing time in ſuch ſuperfluous Diſcourſes, we ſhall here take notice of ſome other things appertaining to the ſaid Inſtrument, more material and uſeful: as the due proportion that its parts ought to have, conſidered in themſelves, and in reſpect of each other.

In the firſt place then, (ſuppoſing that you know the ſtuff wherewithal it muſt be made, which ought to be a tough ſteel, or ſteel and iron together) let the tree of the *Polican* be about four inches long, and ſo perforated, that the diſtance betwixt the centre of the hole (wherein goes the pin, upon which are faſtned the two branches) and one of the extremities, be a line greater than the other. Let one of the two branches be two lines longer than the other; let alſo each claw be three lines long. And finally, let the diſtance between the bolſter, or ſemicircle of the longeſt ſide of the tree, be two lines. And you will have four diſtances between the claws and the bolſters, which is ſufficient to draw all ſorts of *Teeth*. For with the firſt, which is of two lines, you may draw the *Inciſores*.

With the ſecond, of three lines, you may draw the *Canine*. With the third, of four lines, the *Double* and *Treble Teeth*. And with the fourth, of five lines, the *Quadruple* ones.

Your *Polican* being thus made, if you have a mind to uſe it, you muſt ſo apply the Claw to the inſide of the *Tooth* you intend to pull out, that its branch may ſtand exactly upon the middle of the ſaid *Tooth*, gently leaning your Bolſter upon the next to it, the better to take your meaſures; and then draw the *Tooth* out. But take heed you do not draw *obliquely*, but in a direct line from the *Tooth* outwardly; for in drawing laterally, you might chance ſo to force the *Tooth* to be drawn, upon the next to it, that you wou'd draw them both together, or at leaſt looſen very much the ſound one, and put a far greater force upon the other in drawing it, than is neceſſary. Which wou'd occaſion an infinitely greater pain to the *Patient*, than if you had done it rightly.

Thus much have I thought fit to tell you concerning the nature and uſe of the *Polican*; which if you obſerve punctually, you need never fear the Drawing well of any *Tooth*. As for the reſt of the Inſtruments now in uſe, with ſeveral others of my own Invention, I ſhall give you the particular Deſcription, and uſe of every one of them in the next Impreſſion of this Diſcourſe; if you think this worthy of your acceptance.

SECT.

SECT. IV.

Of the Restauration of the Teeth.

WHen our decay'd *Teeth* are so far gone before we think of any Remedy for their preservation, that whatever we can do, proves but fruitless; And that notwithstanding all our best indeavours, they perish, and rot quite away; or that some intolerable pain has made us to draw them; we are not yet to despair, and esteem our selves *toothless* for all the rest of our life: the loss indeed is great, but not irreparable; there is still some help for it, the natural want may be supplied artificially, and herein Art imitates Nature so *natly*, that when the *succedaneous* Teeth (if I may so speak) are well set in, they cannot be distinguished from the natural ones, (neither in colour, firmness, nor proportion) but by them that know of it. Being thus exactly fitted to their place, they will keep the next to them, and by consequence all the rest of that Jaw abundantly firmer and stronger than they would otherwise be.

The Advantages that may be attributed to the artificial *Teeth*, are many; as that they keep the others fast, as we said just now, that they are of a great ornament, and help pronunciation extremely, *&c.* But all that is with a *Proviso*, that they be well made, and according to the best Art; for otherwise they might prove quite contrary.

Besides this Artificial way of repairing the loss of

Teeth, there is another that may be called Natural; which is done by taking out the rotten *Teeth* or ſtumps, and putting in their places ſome ſound ones, drawn immediately after out of ſome poor body's head: which thing (tho difficult) I know to be feaſible enough, not only by my own reaſon that tells me ſo, but by experience it ſelf, as (to ſay no more at preſent) may be inſtanced in the caſe of a certain Lady, who thinking to have *two Teeth* growing one on the top of another, came one day to my Maſter to have one of them Drawn: my Maſter told her that they were not two diſtinct *Teeth*, but only a double one; but the Lady being not ſatisfied with this, deſired him to take out the *Tooth* ſhe had told him of, let it be what it would. The *Tooth* being drawn out, and proving as my Maſter had ſaid, it was quickly ſet again into the Jaw; and with the uſe of ſome convenient and proper Remedies, became in few weeks to be as firm again as any of the reſt.

And yet although the event of this particular had not proved ſo proſperous as it did; its ill ſucceſs would not deſtroy in me the poſſibility of ſuch a tranſplanting, or *Inoculation* of *Teeth*: (if I may be permitted to uſe ſuch terms) that was not the only motive I had to believe it; and I have not inſerted the Story of it here as an Argument to prove invincibly what I ſay, but only as a proper Example to render probable to others what I know to be true. However, I do not like that method of drawing *Teeth* out of ſome folks heads, to put them into others, both for its being too

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inhumane, and attended with too many difficulties; and then neither could this be called the restauration of *Teeth*, since the reparation of one, is the ruine of another; it is only robbing of *Peter* to pay *Paul*. But if instead of humane *Teeth*, there is use made of those of some *Brutes*, as *Dogs*, *Sheep*, &c. In such case I do not only approve of it as lawful and facile, but do also esteem it as very profitable and advantageous; only care is to be had, that the thing be undertaken, and carried on by one that at least knows something of *Anatomy*, and has a right sense of the thing to be done, being furnished with whatever is necessary in an Operation of that nature.

And that (if my Opinion may be any wise serviceable in such an Attempt) I may contribute something towards the improvement of so useful an Invention; I think one is, to proceed in it somewhat after this manner. First, I would chuse an Animal whose *Teeth* should come nearest to those of the *Patient*; as a *Dog*, a *Sheep*, a *Goat*, or a *Baboon*, &c. and having tied his legs together, I would fasten his head in some convenient place, so that he might not stir in the least, and by some proper means keep his mouth open as long as I should have occasion: that done, I would open the Gums round about the *Tooth* to be taken out of his head, not only to the very Jaw-bone, but as far between the said Bone and the Tooth, as the finest Instrument could go, leaving a very little portion of the Gums about it; and then having used the same circumspection, in dividing the Patients Tooth from the

cold Gums

Gums, and the Jaw-bone, I would draw it forth, and put immediately in its place that of the Brute; fastning it very well and streight between the other Teeth: and then with the use of suitable Remedies, I do not question in the least but that it would unite to the Gums and Jaw-bone, and in a little time become as fast as any of the others: which performance might properly be termed the natural Restauration, or *Renovation* of Humane Teeth.

SECT. V.

Of the Tooth-ake, *Loosenes of the* Teeth, *and decay of the* Gums; *with their Remedies.*

THe *Tooth-Ake* is occasioned many and very different ways, but that I may render what I have to say upon it, as perspicuous and intelligible as I can; I think it very convenient we should take a special notice of the vessels that come into the Tooth, and of their respective Functions. The first and chiefest whereof is an Artery, whose Office is to bring directly from the heart that hot and spirituous blood, out of which (although it is not the general Opinion) the Tooth is at first made, (as well as the rest of the whole body) and ever after preserved and repaired by the supply of nourishment, and vital principles it affords continually: To this effect the whole Artery divides it self into an infinity of small branches, which being differminated throughout the whole substance of the Tooth, distribute to each part as much of their

blood

blood as is necessary to make up the incessant loss they are subject to, and the rest is returned through innumerable hair-like veins into the great ones, and thence to the heart again, but in two different manners: for the superfluous part of that portion of the blood, that is carried by the *Capillary* Arteries to that part of the Tooth standing above the Gums, is sent back again through some *Capillary* veins towards the middle of the Tooth; where uniting together, they make but a single channel; and this is it we commonly call the vein of the Tooth, which we shall here take for its second vessel. But the remainder of the blood, that goes to the relief of that part of the Tooth that is within the Gums, passing quite through the substance of the Tooth, is carried by the *Capillary* veins to the veins of the Gums, Cheeks, and Lips, and hence it is that whatever pain is at any time occasioned in any of those parts, (either by bruise, excessive heat, or cold, *&c.*) comes to be soon after communicated to the Teeth.

The Third and Last Vessel of the Teeth is a Nerve, one of the extremities whereof is expanded through the *Membrane* that invests the cavity of the Tooth, and that, that contains its Vessels; and the other is rooted in the Brain, from whence it takes its *Origine*, and where the Animal *Spirits* being elaborated, are thence sent by the Nerves to all the parts of the body, to administer sense, and the cause of motion to them, *&c.* although in some, (as the Teeth) the faculty of motion is not exercised.

From this consideration of the Vessels of the Tooth, we may gather the following reasons of its Dolour; As first, that if either through the too great quantity, or ebulition of the blood, the Artery is so dilated and swoln, that it fills up the hole at the end of the stumps where it enters the *Tooth*, and consequently so compresses the vein going out the same way, that the circulation of the *Blood* is thereby hindred; the continual flowing in of the *blood* will extremely puff up, and distend the *membrane* that contains the vessels, and consequently cause a great pain in the *Tooth*, which will last till either the *preternatural* state of the *Blood* be changed, or that the *Arteriols* which we have said to pass quite through the rooty part of the *Tooth* be so stretched and widened, that by them the *Blood* may be discharged into the Gums, Cheeks and Lips; where it will then cause a swelling, greater or lesser, according to the quantity of the superfluous *Blood*.

And if at the beginning of this disorder, when the Vein is first impeded in its *Function*, the motion of the *Blood* is so rapid, and its influx into the Tooth so impetuous, that before it can make its way through the small *Arterial* Twigs into the Gums, it does extremely extend the coats of the *Artery*, the *Interstices* between their *Fibres* will thereby become wide enough to give passage to some of the thinnest parts of the *Blood*; which gathering at the end of the root, between the outside of the *Artery*, and the common Coat investing all the Vessels, will there putrifie, and cause a great and very lasting pain in the Tooth; during which,

if

if the Tooth be drawn, the ſaid gathering will appear at the end of its ſtump like a little Bladder.

You ſhall know this ſort of *Tooth-Ake* by the high beating of your Pulſe, the fulneſs of the Veins, and an often beating in the affected Tooth; with a continual, tho not very extreme pain. And then for the Cure of it, you muſt firſt bleed the Gums, and ſometimes open a Vein in the Arm alſo, and waſh your mouth with *Roſe-water* and *Vinegar*, of each equal quantities mixt together; putting a little Cotton dipt in *Oyl* of *Bay* into the Tooth, if it be hollow.

Furthermore, if that portion of the *Blood*, which is diffuſed through the ſubſtance of the Brain for the production of the *Animal Spirits*, is ſo depraved, that all the ſifting it receives, through the hidden *meanders*, and receſſes of the Brain cannot clear it from its impurities; and that notwithſtanding all the contrivances of Nature it is depoſited into the *ventricles* of the Brain, (tho under another form yet) ſtill impregnated with its ill qualities: ſuch ſort of *Animal Spirits* being compounded of *Heterogeneous* parts, if not timely diſcharged of their malignant and offenſive *Corpuſcles*, (through the uſual *Emunctories*) will either by their fermentation in the *Ventricles* of the Brain, cauſe an Head-ake; or by the *oppilation* of its pores, cauſe a giddineſs; or elſe paſſing out of the Brain into the Nerves, will by their irregular motion, and preternatural extention of the coats of the Nerves, and other Tunicles, breed a diſturbance in all the parts they go to; but more particularly in the Teeth, in which they

always excite very great pains. For discharging the peccant humour, between the *membrane* that invests the inside of the Tooth, and that that incloses its vessels, it occasions a perpetual torment in them, till it be expelled from thence by *transpiration.*

This second kind of Tooth-ake will be known by a disturbance in the head, which precedes it most commonly; a soreness in the joynts, and a certain droulinesse, and lingring pain all over the body, as if one were inclined to an Ague, with a sharp and very excessive pain in the distempered Tooth, which comes by fits, soon ceasing, and often beginning a-new. As for its Cure, it may be effected by *Sternutation*, the *friction* of the *nape* of the Neck with warm clothes, and the application of *aperitive* Remedies, to open the *pores* of the Tooth: and if it be hollow, you shall put in't a drop of Oyl of *Camphire*, whereinto has been infused some *Henbane-root.* These are the two general causes of the Tooth-ake; all the rest proceeding from them, some few excepted.

There is what I had a mind to say at this present concerning the Tooth-ake. But you must note further, that as it is not enough for one that intends to travel a *Countrey* over, to understand the *Map* of that *Countrey*; but he must also inquire often of the people he meets with as he goes on his journey, for the way to such and such a place: so although I have given you a true account of the Tooth-ake, and have delivered here the right method for the curing of it, yet that Disease is for the most part accompanied with

several

several circumstances, that can't be learnt but from *experience* it self. Thus sometimes the Gums will be *livid*, sometimes *pale*, and sometimes *red*, and inflamed. Sometimes the Tooth is loose, and risen above the others. And sometimes its *root* is discovered, and bare of flesh. Sometimes its *rotten*, and otherwhile *sound*, as to its *substance*. In fine, sometimes the pain is accompanied with a great *fluxion* of *Rhume*, and sometimes with a dryness of the *mouth*, *&c.* Each of which *concomitants* requires a particular consideration, and peculiar Remedies: considering always these things, with reference to the age, constitution and habit of the *Patient*.

Again, it is but rarely, that a *Tooth-ake* is found *simple*, or *uncompound*: (as we have supposed to be, those of which we have treated above) that is, occasioned by one cause only: but it proceeds most commonly from several; and especially if the pain be inveterate, or of a long standing. And then, the *symptoms* of this *complicated* Disease, are mixt in the same proportion as their *causes*; which renders the Cure much more difficult, and subject to more observations. And therefore, if any one has a mind to render himself perfect in these things, he must not only follow our method, that directs him to the true *knowledge* of them, but the *dictates* of his own senses also; by which he will avoid all the *obstacles* he may meet with by the way. Notwithstanding all which, people being commonly unwilling to undergo all the trouble attending a *methodical Cure*, and withal apt to think, that one does them

no good at all, unleſs he gives them eaſe preſently; I have been forced to abandon the *Art* in my practice, and to invent certain general Remedies; which nevertheleſs applying with *circumſpection*, and as I think occaſion requires, hardly ever fail of producing the intended effect: ſometimes in an inſtant, but moſt commonly within leſs than half an hour. True it is, that were it not for my former practice, and long habit in thoſe things, I neither cou'd have, nor expect ſo good a ſucceſs.

And yet I will not deny, but that the ſaid remedies happen ſometimes to *operate* a great deal ſlower than ordinary. But that comes to paſs by reaſon of ſome unexpected, or unobſerv'd *accidents*: and I think it ought to ſuffice, that the Cure be at laſt performed. Yet this does not ſatisfy every body. If the Remedy does not immediately Cure ſuch as are *Impatient* or incapable of reaſoning, they ſtrait condemn it as a thing ineffectual, and altogether void of any *Virtue*. Upon which, believing the Stories of ſome impertinent (tho perhaps well affectioned) friend, they make uſe of ſuch things, as commonly hinder the effect of the Remedy. And if it happens ſometimes that notwithſtanding thoſe impediments, our remedy produces its effect; they never fail of attributing the Cure to their own indeavours.

However, I muſt ingenuouſly confeſs, that my Remedies do not take effect always. And that there are ſome ſorts of *Tooth-ake* almoſt incurable, unleſs it be *palliatively*; and that it ſelf, not without a great deal

deal of trouble, and a tedious while. The reasons of which, I shall take occasion to explain some other time.

The looseness of the Teeth, comes most commonly from the decay of the Gums, which are subject to many infirmities, proceeding for the most part from those things that occasion the *Tooth-ake*, and putrefaction of the Teeth; for sometimes there will be such an affluence of *blood* from the *Teeth* into the Gums, that their veins being not able to contain it, are thereupon broken, shedding the *blood* between the Gums and the *Teeth*: where gathering together, it corrupts, rotting away all the flesh from about the *Teeth*: otherwhiles the *excrementitious* humour, that *exsudates* out of the *Teeth*, falling upon the Gums, eats them away by degrees, *&c.* But above all other things, the scales, and foulness of the *Teeth* are very prejudicial to them. All which infirmities to avoid, you need but to keep your Teeth and Gums neat and clean from any foulness whatsoever; as has been already said in the foregoing Sections: preventing any preternatural collection of *Blood*, or any other humours within the Gums. But if the mischief is already done, that is, if your *Teeth* be really loose, and your *Gums* wasted, you must have recourse for their recovery to one well versed in those things. For to prescribe you here any form of Remedies, would be to no purpose, since the same thing cannot be equally good in all cases, and that without the perfect knowledge of the cause of the Disease, and a right method in applying suitable Medicaments, (which commonly is understood only by

Practitioners in those concerns) it is impossible ever to perform the Cure of any Distemper.

Yet, that you may not think me remiss in any thing belonging to my Profession, that may concern your welfare; and by reason that you may chance to find your selves in a place where there will be no *Artist* to help you; I will here communicate to you a general Remedy against the decay of the Gums, and loosenes of the *Teeth*; which I am sure, if you use carefully, will often answer your expectations: At least it will be such, that it shall always do you some good, and never any harm. But I must tell you before-hand, that if your body be *Scorbutick*, and full of ill humours, you must first be *Blooded*, and *Purg'd*, according to the directions of a good *Physitian*; and then you may use the said Remedy as followeth.

Take of *Mastick*, *Myrrh*, *Pine-Apple*, *Dragons-blood*, in drops, all reduced into Powder, of each equal quantity, red *Coral* prepared, flowers of *Pomgranets*, of each double the quantity of the other *Ingredients*; and steep them all in a proportionable quantity of *Spring-water* upon warm *Embers*, for the space of a natural day; and then *filtrate* the *Infusion* through a woollen-cloth, and keep it close in some convenient vessel. And when you have a mind to use it, you shall take two or three spoonfuls on't a day, keeping it in your mouth a quarter of an hour every time; which you must continue to do while necessity shall require it.

I might have told you at the beginning of this Section, where I spoke of the vessels of the Teeth, that their

their Artery comes from the *Carotids*; the vein from the *Jugular*, and the sinew from the fifth pair of Nerves: but if you are skilled in *Anatomy*, you know it better than I, and if not, my telling of it to you would signify nothing at all, unless I should in the same time, give you an accurate description of all those vessels, tracing them from their *Origine*, even to the very last of their Divisions, and furthest extremities; which would be improper in this place.

SECT. VI.

Of Childrens Teeth.

HAving hitherto spoken of the *Teeth* in reference to adult persons, and such as are past childhood: we shall explain in this Section, as succinctly, and withal as clearly as we can, what is necessary to be known touching their growth, and change in children; a thing of no small consequence, since the life of Infants is therein so often concern'd.

The Child being born, remains *Toothless*, till he is about five or six Months old: at which time his two foremost Teeth in each Jaw begin to appear, without keeping any constant order of Precedence: sometimes those above coming out first, and sometimes those below. After them follow all the rest successively in both *Mandibles*: so next to these come the four other *Incisores*, the four *Canini* or *Dog-Teeth*, and the first eight *Molares*, (which are properly the double *Teeth*) and then come the four biggest *Teeth* of all, which may be

called

called *Quadruple Teeth*, as being about three times bigger than the ſmall ones: and after that the eight laſt *Teeth* do follow; which in reſpect to the *Inciſores* may be termed treble *Teeth*. But theſe treble ones uſually vary very much in time of growth, for it is but rarely that they all come forth in the ſame year, the four laſt of them ſeldom coming out before the one or two and twentieth year of our age; for which reaſon ſuch *Teeth* are called by ſome, *Teeth* of *Wiſdom*; becauſe that by that time, we ſhould have a full uſe of our rational *Faculty*, though God knows how often it proves to be true.

The eight *Inciſores*, and the four *Dog-Teeth* come the firſt year; the eight double *Teeth* the ſecond year, and the four *Quadruples*, with the four firſt *Treble* ones, the third. During the time of their eruption, and eſpecially when the four *Quadruple* ones break forth out of their Sockets, children are ſubject to Fevers, and great alterations, which weakens them extremely, and often puts an end to their days; which comes to paſs moſt commonly, for want of help to facilitate their iſſue out of the Gums.

And as I look upon the knowledge of Childrens *Teeth*, as a ſubject properly belonging to my Profeſſion; ſo I think my ſelf obliged to amend, amplifie, and render it as conducive to the preſervation of the life, and health of Children, and to the preventing of all thoſe Infirmities wherewith they are afflicted, (upon the account of the firſt coming, and ſhedding of their *Teeth*), as my weak indeavours can make it.

And

And therefore I will to that end deliver here in few words, what reason and experience have taught me concerning the same; Proceeding thus,

In the first place, I would advise such as may be concerned in this Affair, to take a special care in observing when the Child's *Teeth* begin to trouble him: which (besides his frowardness, and excessive crying) may be known by his *salivation* or drivelling (as Nurses are wont to stile it,) and the inflammation and swelling of his Gums; and as soon as you perceive it to be so, you are to wash his mouth now and then with the following mixture: *Take* seven or eight as new *Figs* as you can get, and boyl them in a pint or more of *Whey*, till they grow very soft, and then squeeze the *Whey*, and as much of the substance of the *Figs* as you can through a cloth; of which liquor take half a pint, of Honey of Roses, and Syrup of Violets, of each half an ounce, and three or four spoonfuls of *Plantain-water*: mix all together, and keep it close in a Bottel. The best way to use it, is with a stick of Liquorish beaten at one end into small threads like a Comb-brush, or little Broom, with which, being dipt in some of the said Liquor, you shall wash and rub the Childs Gums, (especially where they are tumified) at least five or six times a day, continuing so to do, till you perceive the Gums to grow white above the *Tooth*: (which is a sign of great pain in that part, and that the young *Tooth* will in a little time break through the Gums) and then take a *Lancet*, or a very sharp *Pen-knife*, and divide the white place, cutting it

down to the head of the subjacent *Tooth*, with two *Incisions* crolling one another at the centre of the white spot, continuing to use the mixture as is aforesaid, till the *Tooth* appears above the Gums; observing to use the same method at the coming out of every *Tooth*, which you may know by the foregoing tokens.

Now the *Teeth* being all come out, (except only such as remain latent within the Jaw, till about the two and twentieth year of ones age) they keep firm and strong till the child is a matter of six or seven years old, and then most of them grow loose, and a while after are cast clear out. The *treble Teeth* never change, the *Quadruples* very rarely, but the *Incisores*, the *Dog-Teeth*, and the double ones always do sometimes whole, (and then the *second Teeth*, or those that are to succeed them, are a long time before they grow up again;) but most commonly their head only comes off, the other part remaining still for the making up of the next Tooth; like unto the first production of a Vegetable Seed, or tender Sprig of a young Plant; for as the upper part of this being withered in the *Winter* following, by the rigorous cold of that Season, drops off in the next Spring: (by reason that its texture being yet loose, and less firm, the pores or sap carrying vessels, are over much dilated by the great affluence of the *nutritive* juice, and so give admittance to some indigested and grosser *particles* than is convenient for the nourishment of the Vegetable: which *particles* being irregular, and unactive, their motion is soon stopt; when as a great cold intervening, compresses a little the

the young Plant round about, ſo that they are congeal'd, and become fixt in their *Ducts*, or leading pipes, whereby that part being deprived of its due nouriſhment, fades away, and dries up,) and is ſucceeded by a new Sprout ſhooting out of the ſtump, or remaining part. So likewiſe the young *Teeth* coming into the cold air, when they are yet tender and leſs ſolid: thoſe of them that are more ſuſceptible of alteration, and more expoſed to the inclemency of the weather; (as muſt be thoſe before, which by reaſon of their ſmalneſs and ſituation, cannot but be more ſubject to *adventitious* accidents,) are thereby chill'd and repreſſed, and their parts thruſt near one another, and driven back towards their centre, from whence the ſubſtance of the *Tooth* becoming cloſer, and the intervals between its parts narrower, and interrupted in ſeveral places, by the irregular motion of ſome of the minuteſt of thoſe parts, (which by reaſon of their unſtableneſs, and fluxibility, being diſpoſed to advance and obey the action of external Agents more than the others, do move diſorderly, and ſpoil the ſtructure of the reſt;) the ſmall Veins and Arteries therein diſperſed, will become ſo extremely compreſſed, that the blood they contain (which in Children is moſt commonly groſs and impure, as is apparent by their ſtupidity, and filthy ſcabs, as well as by that Feverish diſpoſition they are always inclined to; which argues a great diſparity between the parts of their blood,) is thereby ſtopt in its courſe, and detained in them; where the groſſneſs of its parts, and their incumbring figures will

soon dispose them to rest, and remain intangled and coagulated together.

If you chance to reflect upon what I say, when I ascribe the great agitation of Childrens Bloud, and its being quiet and fixt in their Teeth, to the same cause, *viz.* its foulness, and the incongruity of its parts; you will perhaps be as angry with me, as the *Satyr* was against the Traveller of the *Fables*, for his blowing hot and cold with the same breath. But if you consider it a little more attentively, you shall find that this, as well as the said *Apologue*, may easily be reconciled with Reason.

Furthermore, the Bloud coming from the live part of the Tooth, to enter the other, and being hindred thereof by the narrowness of the passages, and the resistance of the condensed bloud, is upon that necessarily determined to imploy the force of its motion round about, against the parts lying immediately between the dead portion of the Tooth, and that which is alive; the which it consequently loosens by degrees, and at last breaks them all asunder; separating thus the live body of the Tooth quite from its dead head; and the space left between them permitting the *trunk* to grow, it shoots a new head, which rising above the Gums, thrusts out the old one, becoming a perfect Tooth in its room.

But if in the mean while, through the too great adherence of the dead part to the Gums, the other is depressed, or retarded from growing, and by consequence is detained under the former too long, some of

of the broken *particles* remaining between them, will corrode, and eat holes in the new head of the Tooth, and ſo it comes out already periſhed: which to prevent, the firſt Teeth muſt be drawn out as ſoon as they appear any thing looſe.

Moreover, it happens ſometimes, that the new head of the Tooth is nouriſhed, and increaſes ſo faſt, that being obſtructed by the too great connexion of the old one, to the adjacent parts, from advancing in its right courſe; it turns aſide, and makes its way through either the inſide, or outſide of the Gums; and ſo it grows biaſſing, and out of rank. This defect is remedied by drawing out the ſuperfluous Tooth, and the uſe of ſome convenient means to bring the new Tooth into its place: which is very eaſy to do, if undertaken at firſt, but otherwiſe a great deal more difficult; and eſpecially if the two next Teeth are approached ſo near one another, that it cannot be contained between them, without being leſſened, or the others put further off from each other.

Note, That in drawing out the old, or ſucking Tooth, a great care is to be taken not to hurt the new ones lying under it.

SECT. VII.

Of the Acceleration of the Teeth.

THE five firſt of the foregoing *Sections* have been imploy'd about mens Teeth, and the ſixth about thoſe of Children: but this ſeventh and laſt Section,

of our Diſcourſe ſhall reſpect both men and children, for it will not only teach how to haſten the growth of Childrens ſecond Teeth, when it happens to be delay'd, or retarded too long; but alſo how to *Accelerate* the coming out of thoſe in Men, that are called Teeth of Wiſdom. Which laſt, without the help of Art, hardly ever appear before almoſt half of our life is already paſt away; And when the time of our growth is over: during which, we have the greateſt occaſion for them. But becauſe the bare ſaying or aſſerting of any thing without proofs, or ſome reaſons to render it probable, has no force to perſwade any man of its truth, nor to make him ſenſible of what utility it is of; We will *elucidate* the matter in hand, by an example drawn from the motion of Seeds ſown in the Earth. Now the quick or ſlow *germinating* of Seeds after they have been ſown, depends upon their being buried ſhallow, or deep in the ground; the lightſomneſs or heavineſs of the Earth, and its good or ill manuring, and the proportion of *humidity* that *dilutes* it, as well as the heat or coldneſs of the ſeaſon: the ſeveral proportions of either of which accidents, alter and vary the progreſs of the Seed, according to their prevalency in reſpect of each other.

For in a well prepar'd ſoil, being cheriſhed by the warmth of the Sun, and duly *diluted* with water, the Seed will budd a great deal ſooner; the lightſome Earth eaſily yielding to the *expanſion* of the *Semen*, when it *imbibes* that *Succus Nutritious*, which *Tranſcolating* through the coats of the Seed, and impregnating its

Paren-

Parenchyma, causes by its *fermentation* therein, a gentle shake, and a *vital* motion in the *Radicle*, and *Plume*, (as the Learned Doctor *Grew* calls the *Seminal Root*, and *Trunck* of a Plant in *Embryo*) whereby they are impowered to *Extricate* themselves out of their *Integuments*, and *Parenchyma*; and begin to *vegetate*, and grow like a Plant.

But the Seed being buried deep in a cold, cloggy earth, will, by the stubborn *Cohesion*, and lumpishness of the said earth, be kept from *dilating* it self, and consequently from receiving those *particles* that are altogether necessary for its *nourishing*, and *augmentation*. From whence it follows, that its growth (if not helped by Art) will be check'd, and obstructed till the heat of the Sun has opened the ground, and set its *particles* in such motion as they ought to be, to enter the Seed, and *protrude* the earth upwards.

So likewise Childrens Gums, being yet tender, shallow, and loose, and withal prepar'd, as we have taught heretofore in its place, their first Teeth come out, and grow very easily; as also do their second, if in shedding of the first, their heads only come off; for the others do grow up so soon, that the Gums have hardly any time to close up again. But if the sucking Teeth do shed root and all, the matter out of which the next (which I call *Novel-Teeth*) are to be made, will not only be a considerable time in disposing it self into the requisite form, but when the first lineaments are drawn, and Nature has accomplished her first work, the Gums will be re-united together, and

grown so hard by that time, that their resistance will oppose it self to the growth of these Teeth, till a stronger nourishment produces more and hotter Bloud, and a greater quantity of *Animal Spirits*; by which the Gums being made hotter, and more spungy, and the *nutritive* juice increased, the issue of the said Teeth will then be *facilitated*, and their growth perfected.

To the consideration of these *Novel-Teeth*, may partly be referred that of the last *treble*-ones, or *dentes sapientiæ*. It's true, these are stay'd a great deal longer under the Gums than the others; but also they have more causes that impede their growth. For, besides that, the Gums are more sinewy, and *membranous* about them than any where else, and therefore much more difficult to *penetrate*: That part of the Jaw-bone that contains them, is likewise much thicker, and stronger than any other; and consequently, harder to be divided by the included Teeth; which being incapable of making their way through it, are forced to stay therein till such time that Nature having perfected our growth, the *bloud* becomes hotter, stronger, and its *energy* more powerful by the firmness of the Heart, (which is the Sun of our *Microcosm*, or little-world) and other principal parts, and increase of those *particles* that were wont to be imployed in making up, and augmenting the body; most of which remain then in the mass of the *Bloud*, whereby the said *bloud*, being able to surmount the resistance of the Jaw and Gums, forces the said Teeth to come out of their cells, and grow up.

To

To the efficacy of this new strength of the *Blood*, upon the arrival of Nature to its highest *Period*, may be attributed the causes of those alterations that usually happen in mens bodies about that time: many looking pale, and being troubled with divers infirmities till then, of which they are afterwards delivered. But leaving off Digressions, let us return to our Subject.

We have already observed, that the *Novel-Teeth* in Children, and *Dentes Sapientiæ* in Men, cou'd not arrive to their perfection, nor therefore become serviceable to us without a long time, and a great *Effort* of Nature. It remains now, that (pursuant to our design, as we have declar'd it at the beginning of this Section) we indeavor to find out some means, whereby we may remedy those defects; in *facilitating* Nature's work, and rendring those *tardy Teeth* above-mentioned, serviceable to us as soon as we can. And as I find none more proper and expeditious, than the *Ratification*, and *Dilatation* of the Gums, so that they may lose their greatest stubbornness, and become more yielding to the *Teeth*: I conclude that all the difficulty lies in knowing how such an effect can be produced: which (after a due consideration) I think may be performed after this manner.

In the first place, there is need of an Instrument made of Gold, or Silver, about a foot long, as big as a Tobacco-pipe, and like a *Syringe*, being so bored, that a perfectly *Cilindrical embolus*, or sucker, may fill exactly nine inches of its *Cavity*, the rest being made a good

deal ſmaller, and bow'd like the Blowing-pipe of *Watch-makers*; which ought to end into an head reſembling the cup of an *Acorn*; and ſo contriv'd, that it may imbrace the Gums exactly. Your *Inſtrument* being ready, if you have a mind to perform the *Operation*, you muſt in the next place (concerning the *Dentes Sapientiæ*) tie all the *Teeth* together, (which may be done without any trouble) ſo that the two foremoſt of them may draw the laſt of all towards the fore-part of the *mouth*. By this the included Teeth will be freed from being *compreſſed* between the others, and the extremity of the Jaw-bone. And then the Gums being prepar'd by *Emollients*, and *relaxing* things, apply the end of your *Syringe* cloſe upon the Gums, under which the imperfect Tooth lies, and then draw the *Embolus*, and the top of the Gums will follow, and riſe within the little *Acorn*-like end of the Pipe, as the fleſh uſually doth under *Cupping-Glaſſes*. Keep it a while ſo, and then take away the *Syringe*, and *ſcarify* that part of the Gums that was drawn within the Pipe, in ſeveral places; *reiterating* the ſame *Operation* twice a day, for about a fortnight, omitting only the *Scarification*, which is to be uſed the firſt time only. By this means it appears probable to me, that the Gums yielding, the force of the *Blood* will compel the *fibres* or *minute* parts of the imperfect Tooth, to advance according to their natural order, and ſituation; and ſo cauſe the laſt Tooth to grow.

As to the *Nobel-Teeth*, you ſhall follow the ſame method, and uſe the ſame means in *facilitating* their coming

coming out, that you have done to the others; omitting only the tying of the Teeth, which would be *superfluous* here.

Note, that every thing is not capable of the same perfection, and that as there is no rule without some exception; so when I have asserted such and such things to be improvable to such a degree, it is to be understood for the most part, and in general; not denying but that it may happen otherwise in some particular cases: but I shall always deal candidly with every body, never undertaking any thing but what I shall be able to do according to agreement. And if any one will be pleased to come to my Chamber, he may have my Advice (concerning any thing that belongs to my Profession) *gratis* at any time.

ADVERTISEMENT TO THE READERS.

GENTLEMEN,

ALthough I have offered nothing in this Paper, but what is according to my own Experience, and the best of my knowledge; yet I will not say but that I have been deficient in many things, and have committed a great many Errors in the management of my Subject; but if you consider that I am the first (as far as I know) that ever wrote any thing of this nature; and withal, what is to be expected from one in my Circumstances, I hope you will be the more ready to excuse my faults. However, if what I have done be acceptable to you, I intend in a second Impression of this small Treatise, to Correct, Illustrate, and augment it, to its full proportion. In the mean while I would advise you, to make use of what is here presented you, by

Your very Humble Servant,

CHARLES ALLEN.

Printed in the Year 1686.

A Physical Discourse

WHEREIN

The Reasons of the Beating of the PULSE, or Pulsation *of the* Arteries; *Together with those of the* Circulation *of the* Bloud, *are* Mechanically *Explain'd: Which was never done before.*

THE *Beating of the Pulse* being one of those *Phenomena*, that deserve mans consideration the best, it has excited the most Learned in all Ages to search out what might be the cause of it.

The best *Physitians* and greatest *Philosophers* of former times, being ignorant of the *Circulation* of the *Bloud*, did ascribe it to their occult qualities, and unknown powers.

Galen, an Eminent *Physitian*, searching the natural cause of the *Beating of the Pulse*, thought upon the making of that famous Experiment of his; by which, having put a Quill into an *Artery*, and tied the *Artery* upon it, he found that the said *Artery* ceased from beating betwixt the ligature and the extremity, tho it continued full beating betwixt the same ligature and the heart. And then seeing also, that the *Artery*

being

being untied from about the *Quill*, the *Pulse* would immediately pass beyond the place where the ligature had been made, and beat all along the *Artery*; altho the capacity of the *Quill* remained still the same, he concluded, that the *Pulse* was caused by a *Pulsifick* faculty residing in the coats of the *Artery*.

Gassendus, a Modern and most Learned Philosopher, attributed the said effect, to the *Pulsifick* Faculty of the heart; which, in his opinion, communicates it self to the *Arteries*. Both which opinions (altho propos'd by extraordinary men, yet) are so inconsiderable, that they need no refutation.

The most Learned and most Profound *Cartesius* was of opinion, that the *Beating of the Pulse* proceeded from the motion of the *Blood*, which coming out of the left *Ventricle* of the Heart into the *Aorta*, in a tumultuous manner, extends it self forcibly, and thereby drives all the mass of the *Blood*, from the heart to the heart again, according to the *Circulation* of the Blood. After which this great Man (who would always give natural and intelligible reasons for every thing, as he has done for most;) coming (at the instigation of a *Polyman* of *Louvaine*) to examine *Galen*'s Experiment, he attributed the cessation of the *Pulse*, that happens below the ligature, to the narrowness of the passage of the *Blood* through the *Quill*, which *Blood*, according to the principles of the Philosopher, coming out of the said *Quill* into a wider place, cannot communicate its action to the fides of the *Artery*, but is supposed to imploy the force of its motion forwards, according to the length of the *Artery*. But

But the said *Physician* alledging against this, that if one takes an *Artery* without Quill, or any *Ligature*, and ties its sides so close together, that there be left a far smaller passage for the Blood in that place, than in the Quill; the *Artery* will nevertheless continue still to *Beat* on both sides of the ligature, as it did before: (the contrary of which wou'd necessarily follow, if it were so, that the straitness of the passage of the Blood did occasion the loss of the *Pulse*.) *Carafus* was here forced to recede somewhat from his former *Sentiment*, and to confess, that the motion of the *Arteries* depends partly upon the free continuation of their cours; which totally overthrows his opinion. For, let the power of the said continuation be what it will; happening, as the Philosopher said, that its action may be kept by the compression of the sides of the *Artery*. It is certain, that as the Quill in the *Artery* were of equal, or, if you will, greater capacity than the *Artery*; yet if the said *Ligature* be put upon it, the *Pulse* would, notwithstanding all that, cease below the Ligature. But *Carafus* said, that such a Quill as that we were speaking of just now, being in an *Artery* either tied, or incised, would never hinder any part of the *Artery* from *Beating*. And therefore, &c.

Doctor *Lower* says, after many Disquisitions on this subject, that the knowledge of those things was left to God alone.

Doctor *Willis* attributes the *Beating of the Pulse* to the contraction of the *circular Fibres* of the *muscular* coat of the *Artery*: But it is absurd to think so; for its impos-

sible to imagine that those *Fibres* cou'd contract themselves of their own accord; neither does the Doctor give any reason for what he says. Besides, he's inconsistent with himself, when he ascribes the same motions to the circular *Fibres* of the *muscular* coat of the veins; which are notwithstanding wholly destitute of any *Pulsation*, &c.

All which considering, and how these and other great men had (through the difficulty of the thing, and not out of any insufficiency in them) fallen into so gross and so erroneous opinions concerning the Point in Question; I concluded, that it was as good as impossible ever to solve the difficulty. Yet, recollecting my self, and seeing that the said Effect must have a cause, whatever it be, which probably cannot reside any where else, but either in the Heart, Bloud, or coats of the *Artery*; or finally, in them all together; I made a resolution to examine carefully each one of these things separately, as possibly containing alone the cause sought after; and then all together, as being possibly Coadjutors in the *production* of the known Effect. And after as exact an Inquiry into the matter as I am capable of, my Reasons (which wou'd be too tedious to tell you now) perswade me, that all the Mystery consists in the three following things.

The First is, the Structure of the *Artery*; which is made up of four *Coats*. (We shall examine in another place how they are generated at first.) The first of them, which contains the *Bloud* immediately, seems to be *nervous*, and made of strait *Fibres*; which take

their

their *Origine* from the heart; or rather are a continuation of those that immediately invest the *cavity* of the heart. As soon as they are arriv'd at the *orifice* of the heart, they rank themselves by one another, forming a certain *Cartilagineous* Ring; from the circumference of which, they run almost parallel along the *Artery*; but yet with such an inclination towards one another, that going from the heart to the extreme parts, they form a kind of *Cone*; (for that we may render our Discourse more intelligible; we shall consider here one of the trunks of the great *Artery*, (suppose the ascending one,) as a continued right *Conical Pipe*, abstracting from all its divisions and branches; to every one of which may easily be apply'd, what we are going to say of one of them,) a little below the *Apex* of which, those *Fibres* unite themselves together, and do compose a little *tendinous* ring, called *Anastomosis*: to which is affix'd the extremity of the *vena cava*: which vein we shall suppose here to be a single *conical* channel, or pipe, disposed, as we have taken the *Artery* to be. Within this *Anastomosis* there is a little *Valve* so dispos'd, that it permits the blood to pass from the *Artery* into the vein, but hinders it from returning back again from the vein into the *Artery*. Between every one of those *nervous Fibres*, there is a thin *membrane* that joyns them together, (as the skin in a Goose's foot ties its toes to one another,) which permits the said *Fibres* to open, and go further from one another, when the *Artery* is dilated: And which do continually increase in bredth, as they go from the *Anastomosis* to

the *basis* of the *Artery*: so that they become so conspicuous near the heart, that Doctor *Willis* took them for some large fleshy *Fibres*; to which he asign'd the faculty of shortning the *Artery*, in order to promote the circulation of the Bloud. The second coat is the *Muscular*, and the third the *Glandulous*: but the consideration of these middle coats, being not necessary to our present purpose, we shall speak of them another time. As to the fourth, or outmost Coat, it is that which we have most need to take notice of here; as being the principal Instrument of the *Systole* and *Diastole* of the *Artery*. This Coat is made up of two orders, or ranks of *spiral Fibres*; which proceed from the *oblique Fibres* of the heart; from whence they go twisting and winding themselves about the body of the *Artery*, as *Ivy* does about Trees; some running upon it from the left to the right, and the others from the right to the left; intersecting thus one another *obliquely*, as they go from the heart to the *anastomosis*; whereby they form a sort of Net, or Sieve-like-woof upon the outside of the *Artery*. At their coming out of the heart, they are knitted together by a *cartilagineous* substance, that incompasses the root of the *Artery* round about, as an iron-ring does the end of a handle: from the circumference of which *cartilagineous* Ring, they run *Helix-wise* upon the superficies of the *artery*: at the extremity of which, being arriv'd, they insert themselves into the *tendinous* small ring, or *anastomosis*. These *spiral Fibres* are tied so loosely on the body of the *artery*, and so slightly between themselves, at the places where

where they *interſect* one another, that they may run very eaſily to and fro upon the *artery*.

The ſecond thing conducive to the production of thoſe ſtated turns of *Syſtole's* and *Diaſtole's* of the *artery*, is, that the bloud contains a certain ſubtil matter, or vital ſpirit, which can move it ſelf, and paſs between its parts very eaſily. And in fine, that the bloud coming out of the heart (where it acquires an extreme agitation) into the *arteria magna*, expands it ſelf with great violence, and ſtrongly dilates that part of the ſaid *artery* that lies contiguous to the heart, (forcing in the ſame time the bloud to advance from the heart towards the extremity,) whereby the *ſpiral Fibres* being neceſſarily drawn towards the dilating place, do compreſs the *artery* round about all along, & ſo ſqueeze the ſubtil matter, from between the parts of the compreſſed bloud, into that which is not; forcing it thus to paſs from the extremity towards the heart, which makes the ebbing or *Syſtole* of the *artery*. And then the *ſpiral Fibres* having been extended violently, and on a ſudden, upon the *dilatation* of the *artery*, do (by the *Elaſtick* faculty of ſome of their parts) come back again, and reſtitute themſelves into their former ſituation, and ſtate; forcing thereby the ſubtil matter to fly through the bloud, from the dilated place of the great *artery*, towards the extremity of the *capillary* ones, *&c.* which makes the flowing or *Diaſtole* of the *Artery*.

THE EXPLICATION.

WE have already supposed the *Artery* to be of a right *Conical* figure; let us further, for greater evidence, imagine it to be mentally divided into four parts of equal capacity: so that as much as the first shall exceed the second in bredth, the second will exceed the first in length, *&c.* Let besides, the places of the suppos'd divisions be marked with several letters, as A, B, C, and let A, denote the first division; (proceeding from the heart to the extremity;) B, the second; and C, the third: let us also mark the *Basis* of the *Cylindrical artery*, which is inserted into the *basis* of the heart, by X; and its *capillary* end inserted into the circumference of the *annular anastomosis*, by Y.

And now, suppose that a certain portion of bloud, as a dram for example, passes out of the heart into the *aorta*, where it swells, and dilates it self very considerably, (by reason of a very intense degree of heat, it acquires in the *ventricles* of the heart; and of its being mixed therein with a certain leaven, or *fermentative* juice, (it being the residue of that portion of bloud, that had past immediately before through the heart,) which necessarily causes a great commotion and strife amongst its parts;) it must follow according to true Philosophy, that the said portion of bloud coming out of the heart, does in the same time thrust the bloud already in the *artery*, forwards, and dilates that part of the *artery* that lies contiguous to the heart.

It

It thrusts the bloud, I say, towards the extremity; because that it must occupy a space in the *artery* equal to its natural bulk, neither greater nor smaller; by reason that a like quantity of the bloud to that, that comes out of the heart into the *artery*, is poured out of the vein into the heart; so that there is only room left in the vein to admit just as much bloud, as comes out of the heart at each *Diastole*. And if we suppose the space X A, to contain a dram of bloud, (whether more, or less, makes no matter here) as we have also supposed, that the same quantity comes out of the heart at every *Diastole*, (or *Systole*, as some would have it) it is an invincible truth, that this bloud coming out of the heart, must exactly occupy the space X A; and that therefore, it thrusts in the same time, the bloud that occupied it before, into the space A B; that in A B, into the space B C; that in the space B C, into the space C Y; and that in C Y, into the *capillary* end of the vein, *&c.* And altho (according to our *Hypothesis*) the passage from the *artery* into the vein be much smaller, than that of the heart into the *artery*; yet if the motion of the bloud through the *anastomosis*, is to the motion of the bloud at the *orifice* of the heart, as the *orifice* of the heart is to the *anastomosis*; that is, as X is to Y, (as it may easily be so, altho it is naturally otherwise: the rest of the *anastomoses*, from which we have abstracted here, being together at least as capacious, as the *orifice* of the heart,) it is plain, that a dram of bloud will as soon pass from the *artery* into the vein, as another shall from the heart into the *artery*.

And

And as the bloud coming out of the heart into the great *artery*, cannot poſsibly occupy a greater ſpace, than ſuch as is adequate to its volume in a condenſed ſtate; and that nevertheleſs it dilates it ſelf, it muſt neceſſarily extend and dilate X A, the part of the *artery* that contains it, as much beyond its natural tone, or reach, as the rarefaction of the bloud increaſes its volume; which cannot come to paſs, but theſe two things muſt neceſſarily follow. Firſt, that when the bloud dilates it ſelf, it leaves ſome intervals between its parts; which intervals (becauſe there is no *vacuum* in nature) muſt in the ſame time be filled up with ſome other fluid matter: (which ought to be thinner than the bloud; for otherwiſe it could not paſs between its parts.) And as this ſubtil matter can't come from the heart, becauſe that then it's empty; and that beſides its *orifice* is ſhut cloſe by its three *valves*; it can neither come through the coats of the *artery*, by reaſon of their thickneſs, and cloſe texture; neither is there any ſuch matter about them. It remains then only, that it muſt come from the bloud contained in the *artery*.

Secondly, that the *ſpiral Fibres* muſt be drawn towards the dilated place, and the reſt of the *artery* made as much narrower than ordinary, as X A, becomes wider than it uſes to be. Whereby the *artery* being compreſſed round about, the vital ſpirit is ſqueezed from between the compreſſed parts of the bloud, and forced to advance towards the dilated place; in ſuch manner, that as much of the *ſpirit*, as is neceſſary to fill

up

up the ſpaces left between the parts of the dilated bloud, is ſent thither from between the parts of that, which is compreſſed; the remnant of the *ſpirit* being equally diſtributed through the reſt of the *artery*; ſo that if every one of the four parts, or diviſions of the *artery*, contains a certain quantity of vital *ſpirit*, diſtinguiſhed into three parts, and that three of thoſe parts, do paſs from A B, into X A, two of them will in the ſame inſtant paſs from B C, into A B; and one from C Y, into B C; in which action conſiſts the ebbing, or *ſyſtole* of the *artery*. And as a rope, (or more ſenſibly, a gut-ſtring) which is fixed to any place, being pulled with a jerk, will draw back again him that drew it at firſt; ſo likewiſe the *ſpiral Fibres* being extended vicolently, and on a ſudden, upon the *dilatation* of the *artery*, do come back again *inſtantaneouſly*, (by reaſon that ſome of the parts of each *Fibre*, being ſtrongly thruſted towards its middle, and ſomewhat bent from its circumference towards its centre, do preſently ſpring back again, extending themſelves according to the bredth of the *Fibre*; whereby the ſaid *Fibre* is neceſſarily as much ſhortned, as it had been ſtretch'd before) and reſtitute themſelves into their former ſituation & *tone*; (which they are facilitated to do by the extenuation of that extraordinary agitation of the bloud, which it communicates in an inſtant to the yielding ſides of the *artery*) forcing thereby three parts of the vital *ſpirit*, or ſubtil matter, to repaſs from X A, to A B; and the two parts, that were already in A B, to paſs into B C; from whence another will paſs into C Y, &c.

which makes the flowing, or *Diastole* of the *artery*.

I foresee an Objection, that some may make against what we have said, that that portion of the bloud, that comes out of the heart in its *Diastole*, is dilated, and yet occupies no more of the *artery*, than if it were condensed; only that part of the *artery* which contains it, is a little more extended than the rest: for, they will say, this supposes, that both the *artery* and the vein are always full of bloud; being certain, that if the bloud, in coming out of the heart into the great *artery*, did find there any empty space, where it might expand it self freely, it would start forwards into it, and then it would not dilate the *artery*, nor by consequence draw the *Spiral Fibres*; and therefore there would neither be *Systole* nor *Diastole* in the *artery*. But it is most certain, they will continue, that men have sometimes more, and sometimes less bloud in their bodies: and that if a man has, for example, fifteen ounces of bloud drawn, it will follow, that there being a vacuity in the *Sanguiducts*, till the same quantity of bloud be regenerated a-new, the *Beating of the Pulse* must also cease till then; which being contradicted by daily experience, they will conclude, that the motion of the *spiral fibres*, with whatever else we have taught concerning the *Beating of the Pulse*, is altogether *chimerical*. To which I answer in few words, that for the *Beating of the Pulse*, and Circulation of the Bloud, it matters not at all, whether or no, the *artery* and vein be quite full of bloud; since that as the bloud decreases in them, the muscles of the limbs, and other adjacent

jacent parts, do proportionably compress them round about; so that their internal superficies touches the bloud continually every way; which has the same effect, as if the *artery* and vein were exactly full of bloud: for the bloud coming out of the heart, and finding as much difficulty in lifting up the adjacent parts, as to drive on the bloud of the *artery* and vein, when they are full on't; it's forced to keep the same order and method in that case, as it does in this, concerning its dilatation and place in the *artery*.

Now, these being the true and genuine reasons of the *Diastole*, and *Systole* of the *arteries*, it's very easy thereby to explain all the *Phenomena* relating to *Galen*'s experiment. For the *Quill* being put into the *artery*, and left there without being tied, the *artery* will nevertheless beat still above and below the *Quill*, as it did before; because that the *spiral Fibres* can still play to and fro from one end of the *artery* to the [illegible] without impediment. But if you bind the [illegible] *artery* upon the *Quill*, the motion of the *spiral Fibres* will be intercepted by [illegible], so that it must necessarily follow, (by the foregoing reasons,) that the *artery* being not alternatively compressed, and dilated betwixt the [illegible] *ligature* and the extremity, the *Pulse* must also cease in that part of the said *artery*, &c.

Many things may easily be explained by this Doctrine, tho impossible to be interpreted any otherwise; which therefore become so many proofs of its verity: as namely, the difference which is between the *arte-*

rial and venal bloud. For (having demonstrated above, that when the bloud advances in the great *artery* from the heart towards the *anastomosis*, and from thence into the vein, the vital *spirit* goes in the very same time from the *anastomosis* towards the heart; whereby the said *spirit* is necessarily kept within the *artery*;) it is certain, that this disparity proceeds from the want of *spirit* in the venal to keep its parts in agitation; which abounding in the *arterial*, keeps it in a continual effervency, *&c.* I cou'd add many other things to authorize what we have said concerning the *Beating of the Pulse*, and *Circulation* of the Bloud: but I hope this will suffice to rational men, and such as are of a *Mechanical Genius*. As for those that attribute all things to final causes, and have recourse upon every occasion, to the designs and intentions of Nature; (as when they say, that the Eye-brows are made to hinder the Sweat from falling into the eyes, *&c.*) if, notwithstanding all that we can do, they remain still insensible to our reasons, it matters not much; and, in my opinion, such persons had a great deal better study *Astrology*; or, if they are big with devotion, go and comment upon *Job*, or Paraphrase some *Psalms*, than meddle with *Physical* matters.

FINIS.

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